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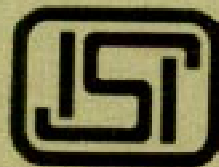


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*Indian Standard*  
SPECIFICATION FOR  
X-RAY LEAD-RUBBER PROTECTIVE APRONS

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**INDIAN STANDARDS INSTITUTION**  
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NEW DELHI 110001

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# Indian Standard

## SPECIFICATION FOR X-RAY LEAD-RUBBER PROTECTIVE APRONS

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# *Indian Standard*

## SPECIFICATION FOR X-RAY LEAD-RUBBER PROTECTIVE APRONS

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 10 March 1974, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Chemical Division Council.

**0.2** Lead rubber being liable to deterioration with age, it is essential that all X-ray protective aprons are visually inspected at frequent intervals not exceeding one month, and in the event of cracks or other suspected deterioration being observed, the aprons shall be subjected to the test given in **4.3.5** and, if found unsatisfactory, should be discarded.

**0.3** In the preparation of this standard, assistance has been derived from BS 3783:1964 'X-ray lead-rubber protective aprons' issued by the British Standards Institution.

**0.4** This standard contains clauses **4.1.5**, **4.2.1**, **4.2.2** and **4.2.3** which call for agreement between the purchaser and the supplier.

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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### 1. SCOPE

**1.1** This specification prescribes requirement for X-ray lead-rubber protective aprons intended to be used during medical X-ray diagnostic examination with X-rays excited at voltage up to 150 kV peak.

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\*Rules for rounding off numerical values (*revised*).

## 2. TYPES

2.1 The aprons shall be one of the following two types as may be ordered:

*Type A* — having a minimum of 0.25 mm lead equivalent for X-rays generated at a voltage of 150 kV peak.

*Type B* — having a minimum of 0.5 mm lead equivalent for X-rays generated at a voltage of 150 kV peak.

## 3. SIZES

3.1 This specification covers three sizes of aprons; large, medium and small differing only in length.

3.1.1 Sizes for the X-ray protective apron shall be so chosen that for persons of large, medium and small frames the aprons extend from the trunk and cover gonads.

## 4. REQUIREMENTS

### 4.1 Materials

4.1.1 *Protective Sheet* — The protective materials of the aprons shall be in the form of a uniform sheet made either from natural or synthetic rubber compound incorporating lead or compound of lead. The sheet made of the protective material shall have the required lead equivalent with uniformity in distribution and shall conform to the tests stipulated in 4.3. The rubber sheet containing the protective material shall be bonded on both sides with cotton sheeting (dyed to *KHAKI* shade or any other agreed colour) conforming to IS : 180-1965\*. Any other fabric or suitable material may be used in lieu if approved by the purchaser. The finished material shall be freely flexible.

4.1.2 *Back Fabric* — The aprons shall be provided with supporting fabric attachment at the back (see Fig. 1) which shall consist of leather cloth (vinyl polymer coated fabric) conforming to Grade 2 fabric of IS : 1259-1962† and of similar colour to that of the protective sheet at the front.

4.1.3 *Tying Tapes* — The aprons shall have tying tapes at the back, as shown in Fig. 1, consisting of two pairs of cotton tape *NEWAR* 40 mm wide conforming to IS : 1895-1961‡.

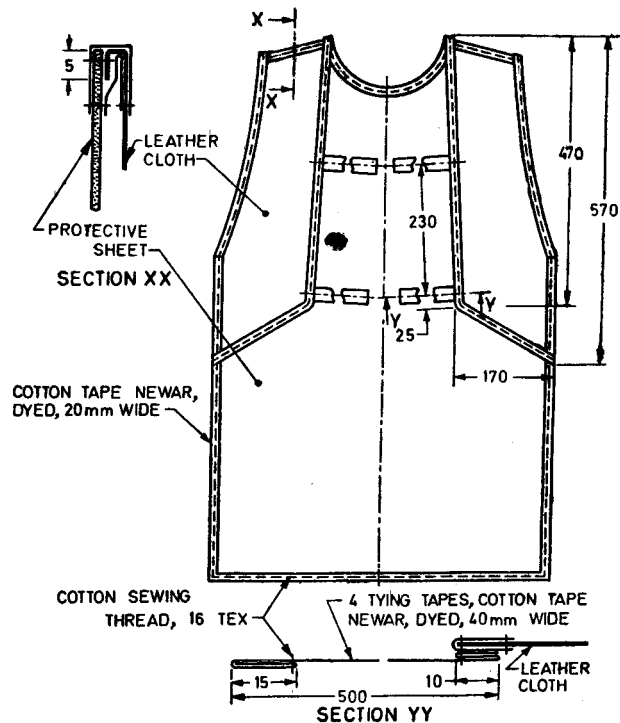
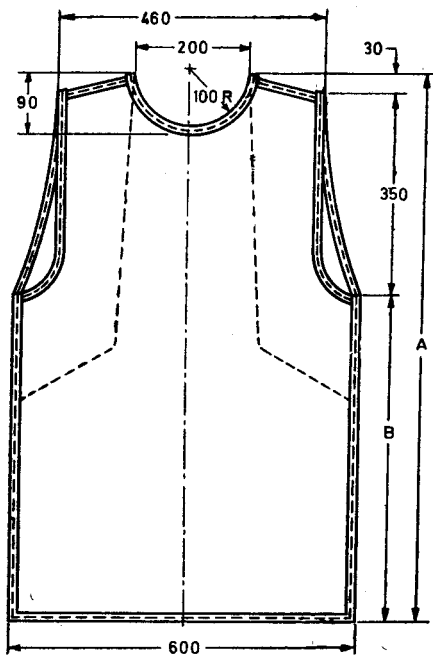
4.1.4 *Edge Binding Tape* — The edges of the aprons shall be protected, as shown in Fig. 1, by means of cotton tape *NEWAR* 20 mm wide, of the quality stipulated in IS : 1895-1961‡.

\*Specification for cotton sheetings (*revised*).

†Specification for vinyl coated fabrics (leathercloth) (*revised*).

‡Specification for cotton tape *NEWAR*, grey or dyed (*first revision*).





Size	Dimension	
	A	B
Large	950	570
Medium	900	520
Small	850	470

All dimensions in millimetres.

FIG. 1 X-RAY PROTECTIVE APRON

**4.1.5 Stitching Thread** — All stitching ( for securing tying tapes and binding tape and back fabric ) shall be done by cotton stitching thread conforming to variety 28 ( 16 tex  $\times$  6 ) of IS : 1720-1969\* or as agreed to between the purchaser and the supplier.

NOTE — The supplier shall submit separate samples of all the component materials for the purpose of carrying out necessary tests on them.

## **4.2 Construction**

**4.2.1 Design and Dimensions** — The aprons shall be made from the body material stipulated in **4.1.1** free from joints, and shall generally conform to the design and dimensions as depicted in Fig. 1 unless otherwise agreed to between the purchaser and the supplier. A tolerance of  $\pm 10$  mm shall be allowed in length and  $\pm 5$  mm in width.

**4.2.2 Mass** — The mass of the aprons shall not exceed the limit as may be stipulated by the purchaser.

**4.2.3** When specified by the purchaser the shoulder pieces shall incorporate a suitable cover padding of soft and resilient material such as, urethane foam, 75 mm wide and extending to a distance of 150 mm on either side of the centre of the shoulder.

## **4.3 Physical Properties**

**4.3.1 Tensile Strength and Elongation at Break** — The tensile strength and elongation at break of the rubber sheet comprising the body materials when tested in accordance with the method prescribed in IS : 3400 ( Part I )- 1965† shall be not less than 5 MN/m<sup>2</sup> ( approx 51 kg/cm<sup>2</sup> ) and 200 percent respectively.

**4.3.2 Tension Set** — The tension set of the rubber sheet body material at 150 percent elongation shall not exceed 30 percent when determined in accordance with IS : 3400 ( Part XIII )-1972‡. The period for which the test piece is kept in stretched condition and of recovery shall be 10 minutes each.

**4.3.3 Adhesion Strength** — The average load required to strip off longitudinally the covering fabric ply from a test piece of finished body material 25 mm wide when tested in accordance with IS : 3400 ( Part V )-1965§ by method A ( machine method ) with 5 cm/minute rate of traverse of the moving grip shall not be less than 1.5 kg.

**4.3.4 Ageing Properties** — The values of tensile strength and elongation at break and of adhesion strength as mentioned in **4.3.1** and **4.3.3** shall

\*Specification for cotton sewing threads ( *first revision* ).

†Methods of test for vulcanized rubbers: Part I Tensile stress-strain properties.

‡Methods of test for vulcanized rubbers: Part XIII Tension set.

§Methods of test for vulcanized rubbers: Part V Adhesion of rubbers to textile fabrics.

not show a change of more than the limits stipulated below against each characteristic when tested in accordance with IS : 3400 ( Part IV )-1965\* at  $70 \pm 1^\circ\text{C}$  for 168 hours in air oven, nor any apparent deterioration in body material like stiffening shall result after such ageing:

<i>Characteristic</i>	<i>Maximum Change in Value from that Obtained Before Ageing</i>
Tensile strength	$\pm 20$ percent
Elongation at break	+ 10 - 25 percent
Adhesion strength	- 30 percent

**4.3.5 Degree of Protection Against X-Rays** — The aprons shall comply with the requirements given in 2.1 when tested in accordance with the method prescribed in Appendix A.

#### **4.4 Workmanship and Finish**

**4.4.1** The aprons shall be free from manufacturing defects such as patches, blisters, porosity, embedded foreign matter, cuts, pinholes, etc, in the rubber sheet and also from other imperfections likely to affect durability or usefulness of the aprons.

**4.4.2** The colour of the tying tape, binding tape and stitching thread shall approximately match the colour of the body of the aprons.

### **5. PACKING AND MARKING**

**5.1 Packing** — Each apron shall be rolled lengthwise and packed in a suitable carton. A suitable number of such aprons shall then be packed inside a wooden box lined with a waterproof liner such that gross mass of the package does not exceed 40 kg. The package shall be safe for rail/road transit.

**5.2 Marking** — Each apron shall be marked legibly and indelibly with the manufacturer's name or trade-mark, year of manufacture, size (length) of apron. The marking ink shall be non-irritating to skin and shall not impair the quality of aprons.

**5.2.1** Each apron may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

\*Methods of test for vulcanized rubbers: Part IV accelerated ageing.

## A P P E N D I X A

( Clause 4.3.5 )

### METHOD OF TEST FOR DEGREE OF PROTECTION OF A COMPLETED APRON

#### A-1. PROCEDURE

**A-1.1** The inspection and testing of the apron shall cover sufficient areas to furnish an assurance that all parts of the apron comply with the specified protective requirements. That part of the apron being tested shall be placed on an X-ray film without intensifying screens, the film itself being placed on a sheet of lead not less than 2 mm thick and a lead step-wedge shall be placed on the film adjacent to the apron. This lead step-wedge shall comprise at least seven steps, the thickness of which shall range from 50 percent less than to 50 percent more than that of the specified requirement. To prevent scattered radiation from affecting the film under the apron, any parts of the film not covered by the apron should be marked with lead or other X-ray opaque material.

**A-1.2** The apron and the step-wedge shall be simultaneously irradiated with X-ray generated at a voltage of 150 kV peak. The exposure shall be of such duration that a suitable photographic density is attained through that step of the wedge which has a thickness equal to that of the specified protective requirements.

**A-1.3** From a photographic examination and comparison of the blackenings produced on the film by the radiation passing through the apron and the step-wedge respectively, the degree of protection afforded by the apron may be assessed relative to the known thickness of the steps of the wedge.

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IS:

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3692-1965 Rubber closures ( pharmaceutical )  
3701-1966 Rubber protective sheaths ( condoms )  
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4135-1967 Hospital rubber sheetings  
4148-1967 Surgical rubber gloves  
4149-1967 Post-mortem rubber gloves  
5680-1969 Rubber tubing for medical use  
5783-1970 Rubber ward-dressing and porter's gloves  
6058-1970 Rubber components for transfusion fluid bottles  
6407-1971 Rubber aprons for hospital use  
7352-1974 X-ray lead-rubber protective aprons

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